GEDAY

AIL Type 74

automatic noise-figure indicator

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CONTROL
CUTLER-HAMMER
AIL DIVISION

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Description

The AIL Type 74 Automatic Noise-Figure Indicator (ANFI) is a device that, with an appropriate AIL Type 70 Noise Generator, provides a continuous and direct meter reading of the noise figure of a device under test. The ANFI may also be used for manual measurements of noise figure.

Application

The AIL Type 74 Automatic Noise-Figure Indicator provides direct and continuous measurement of the noise figure of the device being tested. This permits adjustment of the circuit parameters for minimum noise figure. The device under test may be a complete receiver (radar, television, telemetering, etc.), an amplifier (traveling-wave-tube type, reactance type, etc.) or simply an IF strip. The simple operation of the AIL Type 74 Automatic Noise-Figure Indicator makes it suitable for use both in the laboratory and on the production line.

With the addition of the AIL Type 30 Attenuator, the ANFI can be used to make manual (Y-factor) measurements of noise figure.

Operation

The block diagram shows the relationship between the principal circuits in the equipment and how they are connected to the device under test for both automatic and manual operation.

Automatic

In automatic operation, the modulator, which is controlled by an audio-frequency oscillator, furnishes a symmetrical square wave, switching the noise generator on and off. This causes noise of two known powers to be injected into the input of the device. A signal is tapped off at a convenient point in the IF section of the receiver beyond which no significant noise is introduced. This signal is inserted into the AIL Type 74 Automatic Noise-Figure Indicator through a BNC jack on the front panel. It is then amplified, reduced to video by a detector, and sent to an indicating meter by means of a video amplifier and a synchronous detector. The meter provides direct reading of the noise figure of the device under test. The block diagram shows the waveforms at various points. The square-wave signal from the video amplifier has two levels, V_1 and V_2, which correspond respectively to periods when the noise generator is off and on. V_1 is proportional to the noise power generated in the receiver when its input is terminated in its characteristic impedance at room temperature. V_2 is proportional to the receiver noise power plus the noise-generator power. The reading on the indicating meter is proportional to $V_2 - V_1$. An AGC circuit, fed from the video detector, keeps the average value of $V_2 + V_1$ constant and at a level giving a known value of video detector current, which can be monitored as a calibration check. Under these conditions, $V_2 - V_1$ is a function of the noise figure of the receiver and is independent of gain variations in either the receiver under test or the IF amplifier of the AIL Type 74 Automatic Noise-Figure Indicator.

Manual

For manual measurements of noise figure by the Y-factor method, the noise generator is controlled from the ANFI for CW operation. A front panel control adjusts the circuit so that the indicating meter reads video detector current. With the noise generator "off," the manual gain control is adjusted to establish a reference level on the meter. The noise generator is turned "on" and the AIL Type 30 Attenuator is adjusted until the meter returns to the reference level. The attenuation required is, by definition, the "Y-factor," expressed in db. The noise figure of the device under test is

$$F_{db} = 10 \log \left(\frac{T_2}{T_0} - 1\right) - 10 \log (Y - 1)$$

where

T_2 = effective temperature of the noise generator when fired,

T_0 = 290°K,

Y = ratio of the power output of the device under test when the input is terminated with its characteristic impedance at T_0 to the power output when the input is terminated with its characteristic impedance at T_2.

Versatility

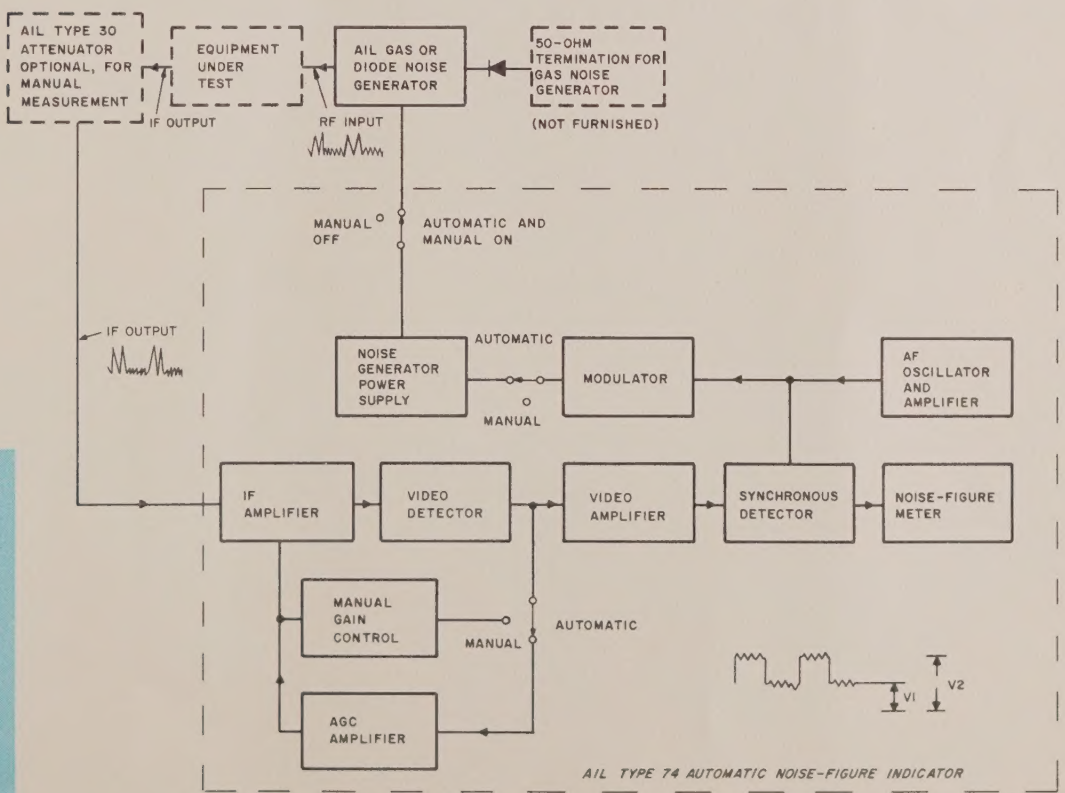
Plug-in IF Strip

Three standard plug-in IF strips are available for the AIL Type 74 Automatic Noise-Figure Indicator. The 30-Mc IF strip has a 6-Mc bandwidth and a sensitivity better than 50 μv. The 60-Mc IF strip has a 6-Mc bandwidth and a sensitivity better than 100 μv. The tunable IF strip accepts an input at 30 Mc or between 40 and 180 Mc with an instantaneous bandwidth greater than 2 Mc and a sensitivity better than 100 μv.

In addition to these standard models, IF strips with other center frequencies, bandwidths, and sensitivities are available on special order.

RF and IF Noise Generators

Eleven AIL Type 70 Series Noise Generators, covering a 10 Mc to 40 kMc range, can be operated from the Type 74 Automatic Noise-Figure Indicator for automatic or manual measurement of noise figure. In addition, AIL has developed the Hot-Cold Body Standard Noise Generator Type 7002 for manual measurement in the 0 to 2 kMc range.



Specifications

RF range	10 Mc to 40 kMc for automatic operation DC to 40 kMc for manual operation
Noise-figure range (automatic operation)	Low scale 0 to 25 db High scale 23 to 36 db, calibrated with extension to infinity
Accuracy (automatic operation)	Low scale ±0.5 db High scale ±1 db
Dynamic range (AGC)	Greater than 65 db
IF gain control	Available for manual operation
Meter function	Noise figure (two ranges), second-detector current, noise-tube current
Power output	Sufficient to operate all AIL noise sources in both automatic and manual modes
Recorder output for noise figure	0 to 0.05 v DC across 10,000 ohms
AGC output	−2 to −6 v DC
Input power	110 v AC, 50 to 60 cps
Overall dimensions	19″ wide × 8¾″ high × 14″ deep
Net weight	44 pounds
Shipping weight	65 pounds

Type 74 ANFI Specifications and Prices

Complete Instrument (including IF strip) Part No.	Price	Center IF Frequency (Mc)	IF Bandwidth (Mc)	Type	Input Sensitivity (into 50 ohms) (μv)	Standard IF Strips* Part No.	Price
7413	$765	30	6	Fixed	50	7403	$275
7416	765	60	6	Fixed	100	7406	275
7414	830	30, 40-180	2	Tunable	100	7404	330

* Other frequencies and impedances are available on special order. Any IF strip may be plugged into the basic unit to change the IF center frequency.

F.O.B. Deer Park, New York
Prices and specifications subject to change without notice.

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